Claims

[c1] What is claimed is:

1. A method for transmitting layer 2 protocol data units (PDUs) in a wireless communications protocol, the wireless communications protocol utilizing a transmission time interval (TTI) in which a predetermined number of PDUs are transmitted, the method comprising:

receiving data from a layer 3 interface;

optionally discarding a portion of the data;

building a plurality of PDUs from the remaining data;

providing each PDU with an n-bit sequence number according to an encoding method, the encoding method comprising:

for each PDU, providing the PDU with a sequence number that is greater than the sequence number of an immediately prior PDU by a first predetermined number if no data was discarded between the data held in the PDU and the data held in the immediately prior PDU, and providing the PDU with a sequence number that is greater than the sequence number of the immediately prior PDU by a second predetermined number if data was discarded between the data held in the PDU and the data held in the immediately prior PDU; and

providing the PDUs for transmission in the TTI.

[c2] 2. The method of claim 1 in which the second predetermined number is greater than the first predetermined number.

[c3] 3. The method of claim 2 in which the first predetermined number is one and the second predetermined number is two to provide for a minimal reuse of sequence numbers.

[c4] 4. A transmitter that encodes layer 2 protocol data unit (PDU) sequence numbers according to the method of claim 1.

[c5] 5. A method for parsing layer 2 protocol data units (PDUs) received in a transmission time interval (TTI), the layer 2 PDUs having sequence numbers encoded by the method of claim 1, the method comprising:

providing a receiving window for the TTI defined by a minimum sequence number value and a maximum sequence number value, wherein a sequence

number is within the receiving window if the sequence number is sequentially on or after the minimum sequence number value and is sequentially on or before the maximum sequence number value;

parsing the sequence number in each PDU received in the TTI to determine if the sequence number is within the receiving window; and

discarding any PDU having a sequence number that is not within the receiving window of the TTI.

[c6] 6. The method of claim 5 wherein the minimum sequence number value is derived from a sequence number in a previous TTI.

[c7] 7. The method of claim 6 wherein the sequence number in the previous TTI is the sequentially greatest sequence number found to be within the receiving window of the previous TTI.

[c8] 8. The method of claim 7 wherein determining the minimum sequence number value comprises adding the first predetermined number to the sequence number in the previous TTI.

[c9] 9. The method of claim 5 wherein determining the maximum sequence number value comprises adding the product of the second predetermined number and the number of PDUs expected in the TTI to the minimum sequence number value.

[c10] 10. The method of claim 9 wherein determining the maximum sequence number value further comprises adding the product of the second predetermined number and a number of unaccounted lost PDUs in a previous TTI to the minimum sequence number value.

[c11] 11. The method of claim 5 further comprising:

providing a maximum sequence number jump limit; and

discarding any PDU in the TTI having a sequence number that is sequentially greater than the sequence number of the immediately prior PDU by the maximum sequence number jump limit.

[c12] 12. The method of claim 11 wherein deriving the maximum sequence number

jump limit comprises multiplying the second predetermined number with a number of unaccounted lost PDUs in the TTI.

[c13] 13. The method of claim 12 further comprising reducing the maximum sequence jump limit when a PDU lost in reception is accounted for in the TTI.

[c14] 14. The method of claim 5 further comprising advancing the minimum sequence number value according to the sequence number of an accepted PDU in the TTI.

[c15] 15. A receiver that parses layer 2 protocol data units according to the method of claim 5.

[c16] 16. A method for parsing medium access control (MAC) protocol data units (PDUs) received in a transmission time interval (TTI), the MAC PDUs carrying logical channel PDUs having sequence numbers encoded by the method of claim 1, the method comprising:

in a current TTI, providing for each logical channel a receiving window according to a receiving window for the channel in a previous TTI, each receiving window defined by a minimum sequence number value and a maximum sequence number value, wherein a sequence number is within the receiving window if the sequence number is sequentially on or after the minimum sequence number value and is sequentially on or before the maximum sequence number value;

for the current TTI, obtaining a plurality of MAC PDUs from a lower level interface, the lower level interface providing information of any MAC PDU lost in reception;

obtaining the sequence number from a first MAC PDU from the plurality of MAC PDUs;

determining the logical channel associated with the first MAC PDU;

determining if the sequence number of the first MAC PDU is within the corresponding receiving window of the logical channel associated with the first MAC PDU;

if the sequence number of the first MAC PDU is within the corresponding receiving window, then advancing the minimum sequence number value of the

corresponding receiving window beyond the sequence number of the first MAC PDU by no more than the first predetermined number; and
for each MAC PDU lost in reception between the first MAC PDU and a subsequent MAC PDU to be parsed, advancing the maximum sequence number value of every receiving window by at least the second predetermined number.

[c17] 17. The method of claim 16 wherein if the sequence number of the first MAC PDU is within the corresponding receiving window, then the minimum sequence number value of the corresponding receiving window is set to be equal to the sum of the sequence number of the first MAC PDU and the first predetermined number.

[c18] 18. The method of claim 16 wherein if the sequence number of the first MAC PDU is within the corresponding receiving window, then the maximum sequence number value of the corresponding receiving window is set to be equal to the sum of the sequence number of the first MAC PDU and the second predetermined number.

[c19] 19. The method of claim 16 wherein if the sequence number of the first MAC PDU is not within the corresponding receiving window, then the maximum sequence number value of the corresponding receiving window is advanced by at least the second predetermined number.

[c20] 20. The method of claim 19 wherein if the sequence number of the first MAC PDU is not within the corresponding receiving window, then the maximum sequence number value of every receiving window is advanced by at least the second predetermined number.

[c21] 21. A receiver that parses medium access control (MAC) protocol data units (PDUs) according to the method of claim 16.

[c22] 22. A method for determining acceptable ranges of received sequence numbers in a wireless communications protocol, the wireless communications protocol utilizing:
protocol data units (PDUs) for transmitting service data units (SDUs), each PDU comprising a sequence number of n bits for indicating a relative sequential

ordering of the PDU in a transmitted or received stream of PDUs; and

a transmission time interval (TTI) in which a predetermined number of PDUs are transmitted or received;

the method comprising:

receiving a stream of PDUs within a TTI;

determining a starting sequence number and an ending sequence number for received PDUs within the TTI; and

discarding any received PDU within the TTI that has a sequence number that is sequentially before the starting sequence number or that is sequentially after the ending sequence number.

[c23] 23. The method of claim 22 wherein the starting sequence number is obtained from an ending sequence number of a previous TTI.

[c24] 24. The method of claim 23 wherein the ending sequence number of the previous TTI is incremented by one to obtain the starting sequence number.

[c25] 25. The method of claim 22 wherein the ending sequence number is obtained by subtracting one from a result of adding the number of PDUs within the TTI to the starting sequence number.

[c26] 26. The method of claim 22 wherein the wireless communications protocol additionally utilizes a length indicator (LI) to indicate an ending position of an SDU within a PDU, and a special value is used for the LI to indicate that PDUs were discarded prior to transmission of the received PDUs.

[c27] 27. The method of claim 26 wherein the special value for the LI enables transmission of sequence numbers in a manner that is predictable for a receiver so that the receiver may generate the starting sequence number and the ending sequence number.

[c28] 28. The method of claim 27 wherein the sequence number of each and every successive PDU in the stream of PDUs is incremented by a fixed value.

[c29] 29. The method of claim 28 wherein the fixed value is one.

[c30] 30. A wireless communications system comprising:

a first station capable of transmitting a stream of protocol data units (PDUs) comprising a predetermined number of PDUs in a transmission time interval (TTI), each PDU comprising a sequence number of n bits for indicating a relative sequential ordering of the PDU in the stream of PDUs; and

a second station capable of receiving the stream of PDUs in the TTI, the second station utilizing:

a starting sequence number;

an ending sequence number; and

an interface for generating the starting sequence number and the ending sequence number, and for discarding any received PDU within the TTI that has a sequence number that is sequentially before the starting sequence number or that is sequentially after the ending sequence number.

[c31] 31. The wireless communications system of claim 30 wherein the interface utilizes an ending sequence number of a previous TTI to obtain the starting sequence number.

[c32] 32. The wireless communications system of claim 31 wherein the interface increments the ending sequence number of the previous TTI by one to obtain the starting sequence number.

[c33] 33. The wireless communications system of claim 30 wherein the interface obtains the ending sequence number by subtracting one from a result of adding the number of PDUs within the TTI to the starting sequence number.

[c34] 34. The wireless communications system of claim 30 wherein the first station utilizes a length indicator (LI) with a special value to indicate that PDUs were discarded by the first station prior to transmission of the stream of PDUs.

[c35] 35. The wireless communications system of claim 34 wherein the special value for the LI enables the first station to transmit the stream of PDUs with sequence numbers in a manner that is predictable for the second station so that the second station may generate the starting sequence number and the ending sequence number.

[c36] 36. The wireless communications system of claim 35 wherein the sequence

number of each and every successive PDU in the stream of PDUs is incremented by a fixed value.

[c37] 37. The wireless communications system of claim 36 wherein the fixed value is one.